

Bryophytes from coastal ecotone of Raigad, Maharashtra: A checklist

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ABSTRACT

In recent years, bryophytes have been studied primarily throughout the Western Ghats, despite less attention made to the coastal area. This study focused on bryophytes in the coastal ecotone. Raigad district situated to northern coastal line of western ghats in Maharashtra. The checklist documents a total of 24 bryophyte taxa recorded in costal ecotone of Raigad. Six liverworts, one hornwort, and seventeen mosses were found. Some of the genera of mosses like *Fissidens*, *Campylopus*, and *Bryum* are found to have largest number of species. In liverworts *Riccia* and *Cyathodium* are recorded to be species rich genera and *Anthoceros* is only representer of hornworts in the coastal ecotone area of Raigad district, Maharashtra.

INTRODUCTION

Bryophytes are one of the earliest and most fundamental groups of terrestrial plants, representing a vital transition from aquatic to terrestrial environments (Renzaglia et al., 2000). Bryophytes are a widespread and distinct category of prehistoric land plants, having an estimated 24,000 species worldwide (Goffinet and Shaw, 2009). As a result, they are the second largest terrestrial plants after flowering plants (Smith, 2004). Today, however, it is only used to refer to the Bryophyta group, which comprises the Hepaticae, Anthocerotae, and Musci (Frey & Kürschner, 2011). These plants are particularly common during rainy seasons and do well in damp environments. While mostly undetectable in the surrounding vegetation, they have the ability to form dense clusters that can cover large areas (Smith, 2004).

The Western Ghats, a significant mountain range in India, is famous for its abundant biodiversity, which includes a wide variety of bryophytes (Manju & Rajesh, 2009). A total of 1224 bryophyte species have been identified in the Western Ghats, which include 21 hornworts, 379 liverwort species, and 824 moss species, across the states of Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu along the Western Ghats. (Manju et.al., 2023). Based on their habitats, they were classified into various categories such as corticolous, folicolous, rupicolous, saxicolous, lignicolous, and terricolous (Daniels and Kariyappa, 2007). As urbanization accelerates and the human population increases, the impact on biodiversity is significant, with bryophytes showing some of the most pronounced effects. Protecting bryophytes is crucial because

of their vital function in ecosystem dynamics. Conservation efforts can include the creation of moss gardens, designated protected areas, and sacred groves. (Dandotya, 2011)

The coastal ecotone, which is the boundary area between land and sea, poses a difficult environment for bryophytes due to high salinity, strong winds, and unpredictable water supply. In spite of these difficulties, bryophytes have been observed to play a crucial and sometimes predominant role in fluvial ecosystems, particularly in coastal areas with substantial rainfall (Vieira et al., 2012). Nevertheless, research has shown that bryophytes are significant and often key contributors to freshwater ecosystems, especially in coastal settings with abundant precipitation (Vieira et al., 2012). In contrast, research on the bryophyte communities of the coastal ecotone in Maharashtra, India, remains limited. The Raigad district features a coastline that is highly indented, stretching approximately 160 km in length, while the actual coastline measures around 240 km due to various creeks and inlets. There are 15 tehsils in Raigad district, with Alibag, Roha, Murud, Shriwardhan, and Mahad being home to significant coastal villages such as Revdanda, Diveagar, Nandgaon, Mankule, and Mhasala along the shore.

Materials and Methods

The present study involves survey of coastal ecotone vegetation area of Raigad. It ranges from Karnala in Panvel Tehsil (73°06'23"E & 18°53'03"N) to Harihareshwar (73°01'13"E & 17°59'31"N) in Shriwardhan. Locations were selected on the basis of ecotone vegetation, rainfall and abundance of bryophytes.

Data gathering, specimen collection, survey of habitats and photography occurred during the monsoon and early winter seasons of year 2023-2024. Basic techniques for collecting specimens and making observations were employed for fieldwork. Field excursions were conducted with all essential equipment needed for the activities, including a field camera and notebook. Bryophyte collection envelopes, a hand lens, a sharp knife, scalpel, writing instruments, and zip-lock bags/collection bags. Identifications were made with the help of Bryophyte flora of North Konkan Maharashtra (Chaudhary et.al. 2008) and also by comparing with protologues. The categorization is founded on the works of Goffinet et al. (2009), Stotler et al. (2009), and Renzaglia et al. (2009) for mosses, liverworts, and hornworts, respectively. All Bryophyte taxa included in the list were checked against the database (www.tropicos.org and www.theplantlist.org)

Observation and result:

The bryophytes listed belong to liverworts, hornworts, and mosses. *Riccia discolor* Lehm. & Lind. and *R. fluitans* L. (Ricciaceae) are thalloid liverworts, the latter being aquatic. *Plagiochasma appendiculatum* Lehm. & Lind. (Aytoniaceae) has a midribbed thallus, while *Cyathodium cavenarum* Kunze. and *C. tuberosum* Kash. (Cyathodiaceae) have simple thalli, the latter with tuberous outgrowths. *Targionia* sp. (Targioniaceae) has leathery thalli. *Anthoceros erectus* Kash. (Anthocerotaceae) is a hornwort with cylindrical sporophytes. Mosses include

Table No. 1: List of bryophytes reported from coastal ecotone of Raigad, Maharashtra.

Group	Sr. No.	Name of species	Family
Liverworts (Marchantiophyta)	1.	<i>Riccia discolor</i> Lehm. & Lind.	Ricciaceae
	2.	<i>Riccia fluitans</i> L.	Ricciaceae
	3.	<i>Plagiochasma appendiculatum</i> Lehm. & Lind.	Aytoniaceae
	4.	<i>Cyathodium cavenarum</i> Kunze.	Cyathodiaceae
	5.	<i>Cyathodium tuberosum</i> Kash.	Cyathodiaceae
	6.	<i>Targionia</i> sp.	Targioniaceae
Hornworts (Anthocerotophyta)	7.	<i>Anthoceros erectus</i> Kash.	Anthocerotaceae
Mosses (Bryopsida)	8.	<i>Brachythecium</i> sp.	Brachytheciaceae
	9.	<i>Bryum coronatum</i> Schwaegr.	Bryaceae
	10.	<i>Calymperes thwaitesii</i> Mitt.	Calymperaceae
	11.	<i>Campylopus gracilis</i> (Mitt.) A. Jaeger	Dicranaceae
	12.	<i>Dicranella</i> sp.	Dicranaceae
	13.	<i>Fissidens bryoides</i> Hedw.	Fissidentaceae
	14.	<i>Fissidens minutus</i> Sull.	Fissidentaceae
	15.	<i>Funaria hygrometrica</i> Hedw.	Funariaceae
	16.	<i>Gymnostomiella vernicosa</i> (Hook) M. Fleisch.	Pottiaceae
	17.	<i>Hyophila involuta</i> (Hook) Jaeg.	Pottiaceae
	18.	<i>Hypnum reflexum</i> F. E. Tripp	Hypnaceae
	19.	<i>Macromitrium sulcatum</i> Brid.	Orthotrichaceae
	20.	<i>Octoblepharum albidum</i> Hedw.	Octoblepharaceae
	21.	<i>Pinnatella calcutensis</i> Fleisch.	Neckeraceae
	22.	<i>Polytrichum commune</i> Var.	Polytrichaceae
	23.	<i>Stereophyllum anceps</i> (Bos. & Lac.) Broth.	Stereophyllaceae
	24.	<i>Trachypodiopsis blanda</i> (Mitt.) Fleisch.	Sematophyllaceae

CONCLUSION

The study conducted in the coastal ecotone forest area of Raigad highlights the significant diversity and ecological adaptability and enlisting of bryophytes across the surveyed locations. This intended to have more attention towards research in bryophytes in tolerant habitats. Their distribution reflects the influence of

Brachythecium sp. (Brachytheciaceae), a creeping moss, and *Bryum coronatum* Schwaegr. (Bryaceae), a cushion moss with erect capsules. *Calymperes thwaitesii* Mitt. (Calymperaceae) and *Campylopus gracilis* (Mitt.) A. Jaeger (Dicranaceae) are small to medium mosses found on trees or soil. *Fissidens bryoides* Hedw. and *F. minutus* Sull. (Fissidentaceae) have two-ranked leaves and found in damp environments. *Funaria hygrometrica* Hedw. (Funariaceae) is a bright green moss with pyriform capsules. *Gymnostomiella vernicosa* (Hook) M. Fleisch. and *Hyophila involuta* (Hook) Jaeg. (Pottiaceae) are small, glossy mosses and common in dry habitats. *Hypnum reflexum* F. E. Tripp (Hypnaceae) observed in wet forests and *Macromitrium sulcatum* Brid. (Orthotrichaceae) are creeping mosses found in grows on trees or rocks. *Octoblepharum albidum* Hedw. (Octoblepharaceae) has pale, glossy leaves commonly lies on wet wooden logs. *Pinnatella calcutensis* Fleisch (Neckeraceae) is pinnately branched, leaves are flat and oblong found in rocks and tree barks. *Polytrichum commune* Var. (Polytrichaceae) is a robust moss with prominent sporophytes mostly on Acidic soils or boggy areas. *Stereophyllum anceps* (Bos. & Lac.) Broth. (Stereophyllaceae) which is prostrate moss with flattened leaves; forms dense mats and *Trachypodiopsis blanda* (Mitt.) Fleisch. (Sematophyllaceae) having slender stems and small, lanceolate leaves form mats or creep in tropical forests.

microhabitat conditions such as rainfall, substrate type, and vegetation.

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Distribution of Bryophyte Species Among Groups

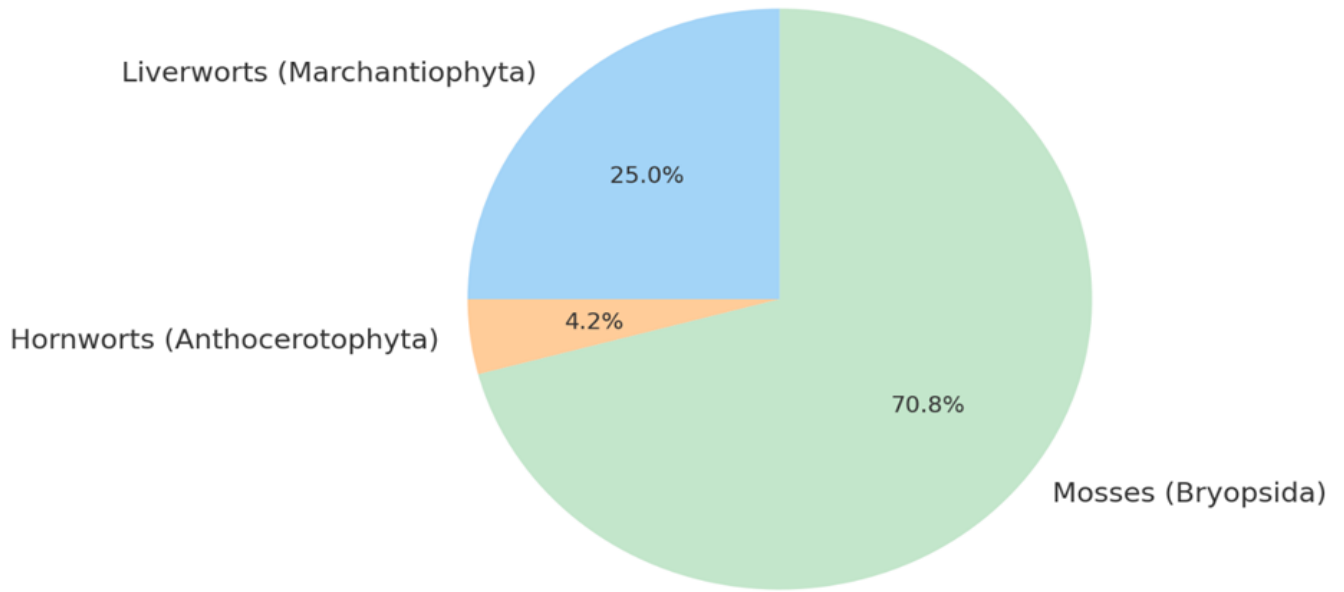


Fig. 1. Distribution of bryophyte species among the three groups: Liverworts (6 species), Hornworts (1 species), and Mosses (17 species).

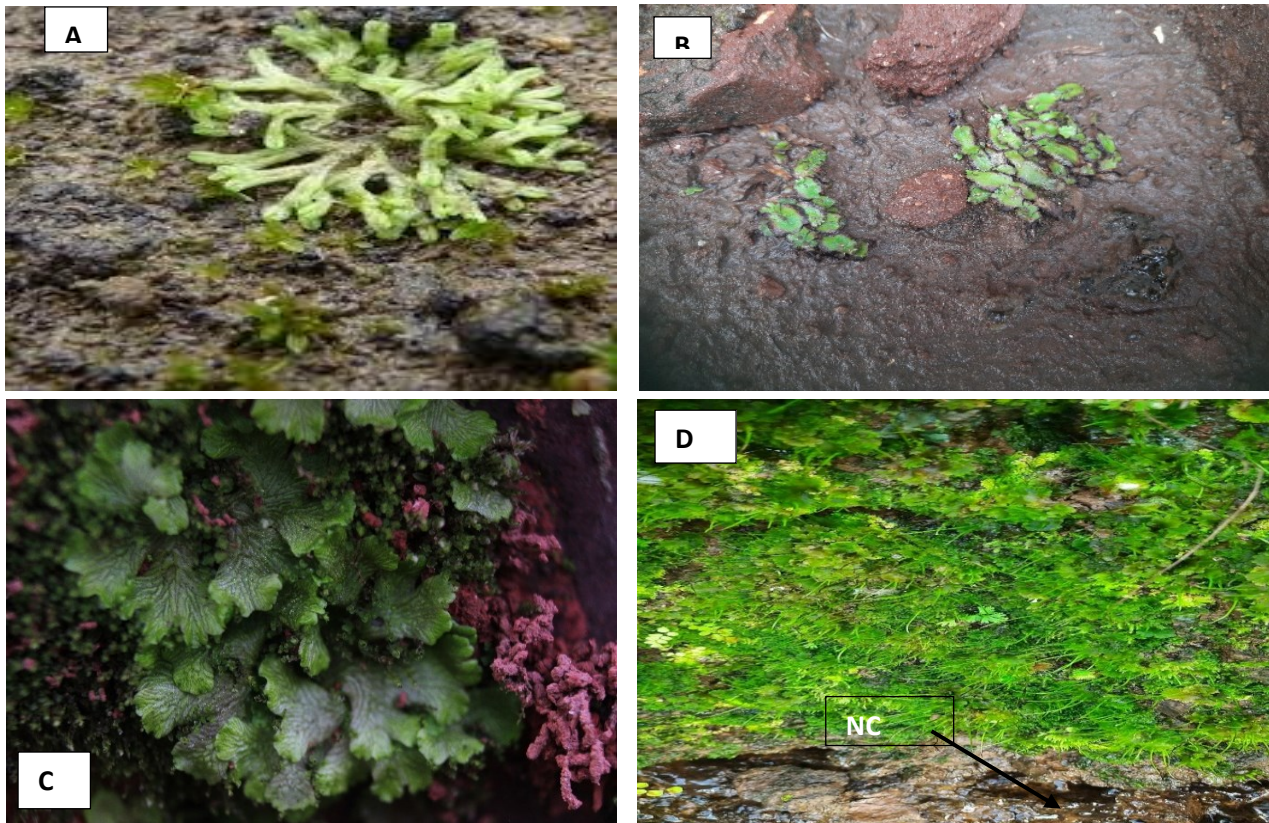


Fig.2. Bryophytes in Natural Habitat; Liverworts; A. *Riccia fluitans*, B. *Targionia* sp. C. *Cyathodium cavernarum*, Hornwort; D. *Anthoceros erectus* (NC: *Nostoc* sp. colony)

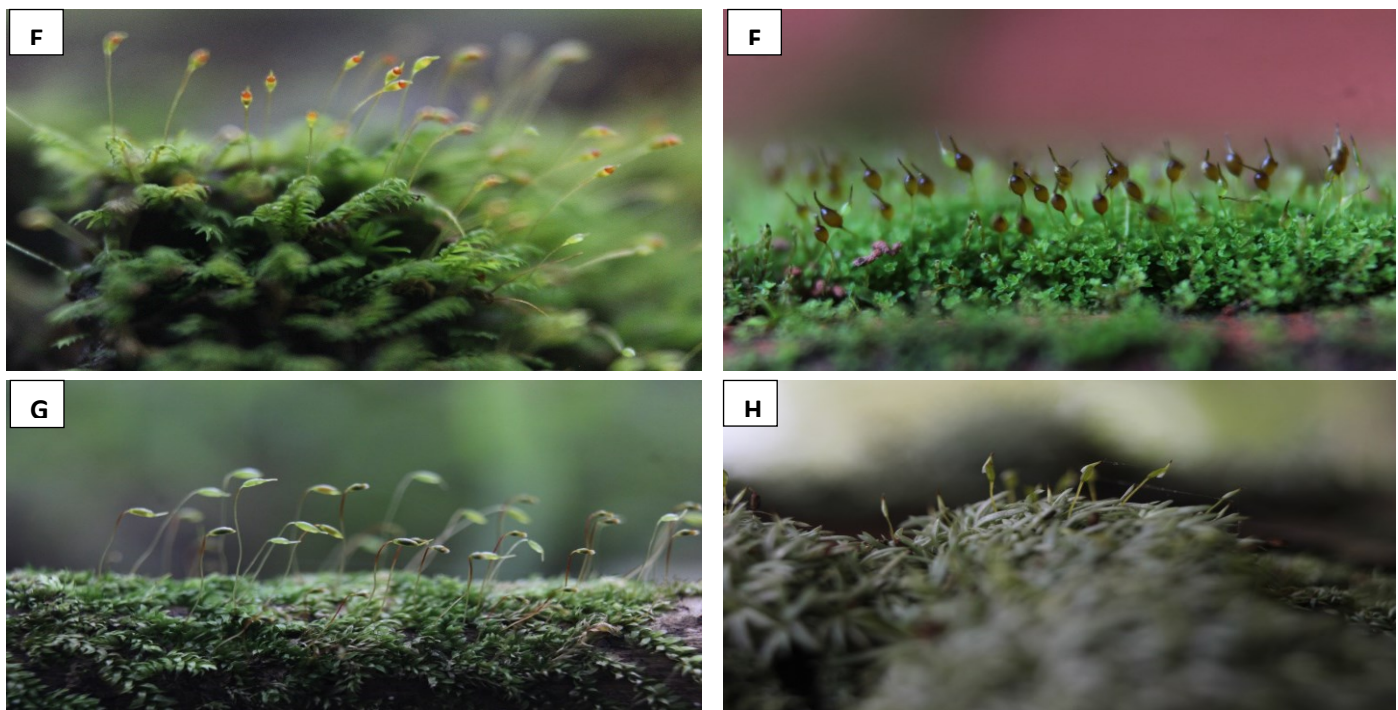


Fig.3. Bryophytes in Natural Habitat; Mosses; E. *Fissidens minutus* F. *Gymnostomiella vernicosa* G. *Hypnum reflexum* H. *Octoblepharum albidum*

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